

# Claims

- [c1] 1. A process for producing acetic acid, comprising the steps of:
- (a) reacting carbon monoxide with at least one reactant selected from the group consisting of methanol, methyl acetate, methyl formate, dimethyl ether and mixtures thereof in a reaction medium comprising water, methyl iodide, and a catalyst to produce a reaction product comprising acetic acid;
  - (b) performing a vapor–liquid separation on said reaction product to provide a volatile phase comprising acetic acid, water, and methyl iodide and a less volatile phase comprising said catalyst;
  - (c) distilling said volatile phase to produce a purified acetic acid product and a first overhead comprising water, methyl acetate, and methyl iodide;
  - (d) phase separating said first overhead to provide a first liquid phase comprising water and a second liquid phase comprising methyl iodide; and
  - (e) adding dimethyl ether to the process in an amount effective to enhance separation of the first overhead to form the first and second liquid phases.

- [c2] 2. A process according to claim 1, wherein the dimethyl ether is added to at least one of said reaction product, said volatile phase, said first overhead, or a stream or column associated with said distillation.
- [c3] 3. A process according to claim 2, wherein the dimethyl ether is added to said first overhead.
- [c4] 4. A process according to claim 1, further comprising the step of removing acetaldehyde from at least one of said first and second liquid phases, and wherein the dimethyl ether is added to a stream associated with the acetaldehyde removal step.
- [c5] 5. A process according to claim 4, wherein the dimethyl ether is added to a return stream from an acetaldehyde removal system.
- [c6] 6. A process according to claim 4, wherein the step of removing acetaldehyde comprises extracting the acetaldehyde from a mixture comprising methyl iodide, and wherein a portion of the dimethyl ether is effective to reduce the quantity of methyl iodide extracted from said mixture with the acetaldehyde.
- [c7] 7. A process according to claim 1, wherein at least a portion of the first liquid phase is employed as a reflux stream in the distillation of the volatile phase.

- [c8] 8. A process according to claim 1, wherein the second liquid phase is recycled to provide a portion of the reaction medium.
- [c9] 9. A process according to claim 8, wherein a majority of the added dimethyl ether is recycled into the reaction medium in the second liquid phase.
- [c10] 10. A process according to claim 9, wherein at least some of the recycled dimethyl ether is converted to acetic acid in the reaction medium.
- [c11] 11. In a method for phase separating a mixture comprising acetic acid, methyl acetate, methyl iodide, and water to provide a first liquid phase comprising water and methyl acetate and a second liquid phase comprising methyl iodide, the improvement comprising adding dimethyl ether to the mixture to facilitate the separation.
- [c12] 12. A method for separating a mixture comprising acetic acid, methyl iodide, and water to provide a purified acetic acid product, a first liquid phase comprising water, and a second liquid phase comprising methyl iodide, comprising the steps of:  
distilling the mixture to provide an overhead fraction and said purified acetic acid product;  
phase separating the overhead fraction to provide said

first and second liquid phases;  
refluxing a portion of the first liquid phase in the distillation; and  
adding dimethyl ether to the mixture, to the overhead fraction or to the refluxed portion of the first liquid phase in an amount effective to enhance phase separation of the first and second liquid phases.

[c13] 13. The method of claim 12, wherein the dimethyl ether is added to the overhead fraction.

[c14] 14. The method of claim 12, wherein the mixture is provided as a volatile phase of a reaction product of a carbonylation reactor.